EFFECT OF COOKED PIGEON PEA (*Cajanus cajan*) SEED MEAL ON THE PERFORMANCE OF BROILER CHICKS

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ABSTRACT

Two hundred seven day old broilers were used to determine the effect of cooked pigeon pea seed meal (CPSM) on the performance of broiler chicks. The brown coat coloured pigeon pea seeds were cooked for one hour, sun-dried and milled. CPSM was included in the broiler starter diets 1, 2, 3, 4 and 5 at 0, 20, 30, 40 and 50% levels respectively to replace maize and soybean meal. Data on weight gain, feed intake were recorded and used to calculate the feed conversion ratio. Feed cost and cost of feed per kg weight gain was also determined. The results of this study indicated a slight reduction in crude protein content of pigeon pea seed meal after cooking. CPSM significantly ($P<0.05$) depressed weight gain progressively with increasing dietary level. Birds on diets 3, 4 and 5 did not indicate any significant ($P>0.05$) difference in weight gain. Birds on diet 1 recorded the highest feed intake, which was significantly ($P<0.05$) different from birds on diets 2, 3, 4 and 5. However, birds on diet 1 recorded the lowest feed conversion ratio (1.99) and the least feed cost per kg weight gain (₦54.60), though with the highest cost of feed per kg (₦27.44).

INTRODUCTION

The improvement in the nutritional requirements of poultry occasioned by the introduction of fast growing and genetically improved strains have posed a challenge to nutritionists in most developing countries. This is because, the feed ingredients required to achieve optimum performance from these birds are getting increasingly expensive due to competition with man and industrial concerns. Most modern poultry feed formulations make use of maize, soybean meal or groundnut cake as the base ingredients, but these ingredients are finding other applications in human nutrition. This has prompted renewed effort at finding cheaper alternatives to sustain production of poultry and maximize the potentials of the improved poultry strains available, at a reasonable cost. Interests have naturally been on the oilseeds, the legumes in particular. According to Arora (1995), legumes are two to three times richer in protein than the cereal grains. Jack beans, velvet beans, lima beans and pigeon pea are among the legumes that hold promise as poultry feed ingredients (D'Mello, 1995; Okuku, 2002).

Pigeon pea {*Cajanus cajan* (L) Millsp} is a legume grown mainly in the middle belt of Nigeria. It is moderately yielding, producing 300 – 3000kg ha^{-1} of dry seeds in native farms (Phillips, 1977; Adeparusi and Balogun, 1999). According to Udedibie and Igwe (1989), pigeon pea consumption in Nigeria is quite low possibly because of the availability of other beans, which are

easier to cook. A wide variability exists in the chemical composition of pigeon pea seeds due to genotype, growth conditions and duration/condition of storage (Salunkhae *et al,* 1985;D'Mello, 1995; Amaefule and Onwudike, 2000). Raw pigeon pea contains 14.0 –28.9% crude protein, 1.0 – 9.0% ether extract, 5.0 – 9.4% crude fibre, 3.5% ash and 36.0 – 65.8% NFE (Oyenuga, 1968 and Kay, 1979). Akroyed *et al* (1982) reported 20.4% crude protein and 63.4% carbohydrate for raw pigeon pea seeds. The metabolisable energy (ME) content of the seeds varies from 10.66 – 13.70 MJ kg^{-1} for various species of animals. Pigeon pea contains relatively high amount of fibre, which contributes to its relatively poor nutritional value (Arora, 1995).

Pigeon pea seeds contain some anti – nutritional factors principally, trypsin inhibitors, which is easily destroyed by heat (Apata and Ologhobo, 1997). Sigh (1983) reported that cooking significantly increased the true protein digestibility of pigeon pea seeds. Cooking also slightly reduced the true protein content of pigeon pea seed meal (Udedibie and Mba, 1996). Amaefule and Obioha (1998) reported that pigeon pea boiled for 30minutes replaced up to 100% and 33.33% groundnut cake and maize in broiler finisher diet. Udedibie and Mba (1996) also indicated that pigeon pea seeds hold promise as poultry feed ingredients. This study was therefore aimed at evaluating the effect of cooked pigeon pea seed meal on the performance of broiler starter chicks.

METHODOLOGY

Brown coat coloured pigeon pea seeds were sourced from Enugu state in the Southeastern Agricultural zone of Nigeria for this study. Whole pigeon pea seeds were immersed in four times its volume of cold water in a large pot set over burning firewood. The seeds were allowed to boil for 1 hour at 100°C, strained out of water, sun- dried, milled and stored in bags labeled CPSM. Sample of the CPSM was analysed for proximate composition (AOAC, 1990).

Five broiler starter diets were formulated such that diets 1, 2, 3, 4 and 5 contained 0, 20, 30, 40 and 50% CPSM respectively replacing, 0, 20, 30, 40, and 50% of maize and 0, 40, 60, 80 and 100% of soybean meal respectively. Diet1 was the control diet (Table 2). Two hundred seven day old broilers were divided into 5 groups of 40 birds each with similar average weight. The groups were randomly assigned to the 5 experimental diets in a completely randomized design (CRD). Each treatment group was replicated 4 times giving 10 birds per replicate. Each replicate was housed in 2m x 2m deep litter compartment. All routine vaccination and management schedules for broilers were strictly followed. Feed and water were provided *ad libitum*. The study lasted 28days.

Chicks in each replicate were weighed at the beginning of the study and on a weekly basis thereafter. Feed consumption was determined by obtaining the difference between quantity of feed offered and the

leftover the following morning. Data obtained were used to calculate the daily weight gain, daily feed intake, feed conversion ratio, feed cost per kg and feed cost per kg weight gain for the 5 treatment groups. The treatment means were subjected to one – way analysis of variance, where treatment effect were detected, means were compared using the Fischer's Least Significant Difference (F-LSD) as outlined by Little and Hills (1978), Table 3.

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of cooked pigeon pea seed meal. The crude protein value of 21.31% is slightly lower than 22.5% reported by Okuku (2002) for raw pigeon pea seeds. This is in agreement with Udedibie and Mba (1996), Emenalom and Udedibie (1998), indicating that crude protein is slightly reduced by cooking due to solubilisation of some nitrogenous substances in the cooking water. Crude fibre, ether extract, ash and NFE varied with values obtained by Amaefule and Obioha (2001). Ash and NFE showed a decrease after cooking when compared to values obtained by Okuku (2002) for raw pigeon pea seed while ether extract indicated an increase.

The performance of broiler chicks on cooked pigeon pea seed meal (CPSM) is presented in Table 3. Daily weight gain depressed significantly ($P<0.05$) between birds on diets 1 and diets 2, 3, 4 and 5. However, birds on diets with CPSM differed in daily weight gain non-significantly ($P>0.05$) except at 20%

dietary level (diet 2), daily weight gain decreased with increasing dietary level up till 40% dietary level before increasing slightly at 50% dietary level (diet 5). The depressed eight gains may have resulted from the lower crude protein, which contrasted with the increasing metabolisable energy (ME) content of the diets. Also, the increased crude fibre content of the diets may have diluted the crude protein and thus reduced its bioavailability (Arora, 1995). Tangtweewipat and Elliot (1989) achieved a satisfactory performance of birds fed raw pigeon pea seed meal with methionine, lysine and energy supplementation. Therefore, the poor performance of the birds on CPSM due to low crude protein content of the diets may have been aggravated by amino acid deficiency and imbalance (Pezzato *et al*, 1997; Adeparusi and Balogun, 1999).

Birds on diet1 recorded the highest feed intake, which was significantly ($P<0.05$) different from 2, 3, 4 and 5. Feed intake increased from diet 2 to 4 and reduced significantly ($P<0.05$) in diet 5. The increased feed intake suggest that boiling for one hour was enough to eliminate the anti-nutritional factors in pigeon pea seed meal (Amaefule and Onwudike, 2000). The slightly higher crude fibre content with increasing dietary level of pigeon pea seed meal may have contributed to higher feed intakes in spite of the apparently higher energy levels of CPSM diets. Feed conversion ratio increased progressively with increasing dietary CPSM. This increase was only significantly ($P<0.05$) different from

diet1 (control) at diet 4 (40% CPSM). Feed cost per kg was highest for diet 1 and expectedly least for diet 5. However, feed cost per kg weight gain was highest for diet 4 and lowest for diet 1. Feed cost per kg weight gain differed significantly ($P<0.05$) between diets 1 and 3, 4, 5.

CONCLUSION AND RECOMMENDATION

The results indicate that pigeon pea seed cooked for one hour can completely replace soybean meal and maize partially in broiler starter diet but with depressed performance in terms of weight gain and feed cost per kg weight gain. It would appear that cooking for one hour is enough to destroy the anti-nutritional factors in pigeon pea seeds. However, consideration should be given to further studies involving amino acid supplementation of diets containing CPSM in order to improve the performance of broiler chicks and cost of feed per kg weight gain.

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Table 1: Proximate composition of cooked pigeon pea seed meal (g kg^{-1} DM)

Nutrients	**Cooked PSM***	**Raw PSM***
Dry matter	913.1	
Crude protein	213.1	225.0
Ether extract	87.4	44.1
Ash	25.7	31.2
Crude fibre	71.2	ND
Nitrogen Free Extract (NFE)	602.6	701.4

* Pigeon pea seed meal ND = Not determined

Table 2: Composition of experimental broiler starter diet (g kg^{-1})

Feedstuff* (g kg^{-1})	Diets			
	1	2	3	4	5
Maize	500.0	400.0	350.0	300.0	250.0
Soybean meal	250.0	150.0	100.0	50.0	0.0
CPSM**	0.0	200.0	300.0	400.0	500.0
Vit/Min. Premix***	5.0	5.0	5.0	5.0	5.0
Calculated Composition (g kg^{-1})					
Crude protein	234.8	231.8	230.3	228.8	227.7
Ether extract	36.5	31.5	28.9	26.3	23.8
Crude fibre	38.8	39.1	39.2	39.3	39.5
Total calcium	13.2	13.2	13.2	13.2	13.2
Total Phos-phorus	8.0	7.9	7.8	7.8	7.7
Lysine	14.5	16.8	18.1	19.3	20.5
Methi-onine	4.0	3.5	3.3	3.0	2.8
ME (MJkg^{-1})	12.03	12.06	12.08	12.09	12.10

*Each diet contains the following (g kg^{-1}): Wheat bran – 80.0, palm kernel cake – 40.0, fish meal – 40.0, blood meal – 50.0, bone meal – 30.0 and common salt – 5.0.

**Cooked pigeon pea seed meal

*** To provide the following per kg of feed: vitamin A, 10,000 iu; vitamin D_3, 2000 iu; vitamin E, 5 iu; vitamin K, 2mg; riboflavin, 4.2mg; vitamin B_{12}, 0.01mg; pantothenic acid, 5mg; nicotinic acid, 20mg; folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 1.0mg; Zn, 5.0mg; Co, 1.25mg; Iodine, 0.8mg.

Table 3: Performance of broiler starter chicks fed cooked pigeon pea seed meal

Parameters	Diets					
	1	2	3	4	5	SEM
Initial live wt (g)	115.9	116.0	115.5	115.0	115.0	0.30
Final live wt (g)	980.4^{a}	823.0^{b}	698.8^{c}	678.0^{c}	678.5^{c}	15.12
Dly fd intake(g)	61.6^{a}	54.3^{bc}	55.9^{b}	56.5^{b}	53.3^{c}	0.80
Daily wt gain(g)	30.87^{a}	25.25^{b}	20.83^{c}	20.11^{c}	20.12^{c}	0.96
Feed conv ratio	1.99^{a}	2.15^{ab}	2.68^{ab}	2.80^{b}	2.65^{ab}	0.26
Feed cost (₦/kg feed)	27.44^{a}	26.81^{ab}	26.49^{bc}	26.18^{bc}	25.86^{c}	0.27
Feed cost (₦/kg wt gain)	54.60^{a}	57.64^{a}	70.99^{bc}	73.30^{c}	68.53^{b}	1.29
Mortality (No.)	0.0	0.0	1.0	0.0	1.0	0.0

abc means with different superscript within rows are significantly ($P<0.05$) different